



Lankesteriana International Journal on
Orchidology

ISSN: 1409-3871

lankesteriana@ucr.ac.cr

Universidad de Costa Rica
Costa Rica

Fernández, Melania; Bogarín, Diego; Karremans, Adam P.; Jiménez, Daniel
NEW SPECIES AND RECORDS OF ORCHIDACEAE FROM COSTA RICA. III
Lankesteriana International Journal on Orchidology, vol. 13, núm. 3, enero, 2013, pp. 259-
282
Universidad de Costa Rica
Cartago, Costa Rica

Available in: <http://www.redalyc.org/articulo.oa?id=44339826007>

- How to cite
- Complete issue
- More information about this article
- Journal's homepage in redalyc.org

redalyc.org

Scientific Information System

Network of Scientific Journals from Latin America, the Caribbean, Spain and Portugal
Non-profit academic project, developed under the open access initiative

NEW SPECIES AND RECORDS OF ORCHIDACEAE FROM COSTA RICA. III

MELANIA FERNÁNDEZ^{1,2,4}, DIEGO BOGARÍN^{1,2}, ADAM P. KARREMANS^{1,3} & DANIEL JIMÉNEZ¹

¹Jardín Botánico Lankester, Universidad de Costa Rica, P. O. Box 302-7050 Cartago, Costa Rica.

²Herbario UCH, Universidad Autónoma de Chiriquí, 0427, David, Chiriquí, Panama.

³Naturalis Biodiversity Center - NHN Universiteit Leiden, The Netherlands.

⁴Corresponding author: melania.fernandez@ucr.ac.cr

ABSTRACT. The establishment in Costa Rica of the great naturalist Charles H. Lankester in the 19th century brought a tremendous increase in the knowledge of Costa Rican Orchidaceae. His desire to leave the collections kept at his farm for a scientific and educational purpose was finally accomplished in 1973 with the foundation of Lankester Botanical Garden (JBL). Since then, JBL has followed Lankester's legacy with its consolidation as a leading center for the study of Neotropical orchids, resulting among others in more than 180 new Costa Rican species and records in the last 12 years. This manuscript includes the description of four new species and seven new records, as part of JBL's contribution to the completion of the Costa Rican orchid inventory.

KEY WORDS: *Epidendrum jorge-warneri*, *Platystele tica*, *Platystele catiensis*, *Platystele sylvestrei*, new species, new records, Orchidaceae, Costa Rica

Costa Rica has witnessed the emergence and consolidation of some of the finest botanists and naturalists of the Americas at the beginning of the last century. Names like Alberto Manuel Brenes, Charles H. Lankester, Henri Pittier, Adolphe Tonduz, Karl Wercklé, can be found among those who made significant contributions to the knowledge of Costa Rican flora. All but one of them shared a common scientific background. Charles H. Lankester (1879-1969) first arrived in Costa Rica at the end of the 19th Century, hired for three years by the Sarapiquí Estates Ltd. coffee company. Captivated by the natural richness of the country, he came back from England a few years later to build a life in Costa Rica. His inclination and acute observation of natural creatures and phenomena in general, and of epiphytes in particular, soon brought the attention of some of the greatest orchidologists and botanists of the time: Dr. Oakes Ames (University of Harvard Herbarium), Paul C. Standley (Director of the United States National Museum) and Robert Allen Rolfe (curator of the orchid herbarium at the Royal

Botanical Gardens, Kew), with whom he shared his many findings, product of his trips to botanically-rich areas in the region of the Cartago province. Lankester's tremendous passion for plants, great capacity to recognize details, and extraordinary horticultural skills made a significant contribution to the foundation of Costa Rican orchid studies. His last dream to preserve the botanical collections held in his farm and to make a contribution to conservation came true in 1973 with the foundation of the Lankester Botanical Garden.

This paper is the third part of a series aimed towards the completion of the Costa Rican Flora Orchidaceae. In the last few years knowledge on the Costa Rican orchid flora has grown substantially (Bogarín *et al.* 2008; Karremans *et al.* 2012). Bogarín (2011) reported 1519 species for the country, which meant up to 20 additions per year in the last decade. That trend was expected to be maintained by Karremans *et al.* (2012), but even though the country already hit the 1600 species mark (Karremans & Bogarín 2013), the novelties might increase rather than decrease in the

* This contribution was prepared as part of the special edition of LANKESTERIANA dedicated Lankester Botanical Garden's 40th anniversary.

coming years. Here, we describe four new species and report the presence of six new records, illustrated with both photographs and detailed line drawings. Although *Sobralia bletiae* Rchb.f. was previously known to occur in Costa Rica, an illustration and photograph based on a Costa Rican specimen is also included.

1. *Epidendrum jorge-warneri* Karremans & Hágsater, *sp. nov.*

TYPE: Costa Rica. Puntarenas: Buenos Aires, Buenos Aires, Olán, cumbre del Cerro Tinuk, 9°17'29.1" N 83°10'11.2" W, 2417 m, bosque pluvial premontano, epífitas en bosque de páramo, 25 julio 2012, A.P. Karremans 5545, D. Bogarín, D. Jiménez & V.H. Zúñiga (holotype, CR!; isotype, JBL-Spirit!; figs. 1, 14A).

Epidendro anoglossoides Ames & C.Schweinf. *simile sed planta minore, caulis complanatis, folia breviora, floribus majoribus, sepalis et petalis longiores, labello lanceolato longiore differt.*

Epiphytic, sympodial, caespitose, erect *herb*, up to 20 cm tall. *Roots* from the base up to above half the length of the stems, fleshy, filiform. *Stem* 15-20 cm tall, branching conspicuously, cane-like, laterally flattened, erect. *Leaves* up to 5, distributed along the stem, mostly close to the apex as the basal ones fall off with time; leaf sheath tubular, rugose, 1.5 cm long; blades 2.8-3.6 × 0.8-1.3 cm, elliptic to narrowly-ovate, obtuse bilobed, articulate. *Spathaceous bracts* lacking. *Inflorescence* apical, mostly from lateral branches, distichous, flowering only once; peduncle up to 2 cm long; rachis curved, laterally flattened. *Floral bracts* equal to longer than the ovary, acute, flattened, 1 cm long. *Flowers* 2-4, simultaneous, resupinate, brownish-yellow; fragrance sweet during the day. *Ovary* 8.0-8.5 mm, laterally compressed, prominently inflated throughout. *Sepals* free, spreading, the dorsal prominently bent inwards, narrowly-ovate to elliptic, acute, 9-veined, margin entire; the *dorsal sepal* 15 × 3.5 mm; the *lateral sepals* 15 × 4.0-4.5 mm, oblique. *Petals* 13.0-13.5 × 1.5-2.0 mm, spreading, strongly bent backwards, ligulate to narrowly-elliptic, obtuse, 3-veined, margin entire. *Lip* 12.5 × 5.5-6.0 mm, united to the column, ovate-lanceolate, slightly 3-lobed, margin wavy, embracing the column, completely covering it; callus Y-shaped, prolonged into a central rib extending to the apex of the

lip; lateral lobes hemi-rhomboid; mid-lobe triangular, acute, apiculate. *Column* 3.5 mm long, straight, with two apical somewhat rounded wings. *Clinandriumhood* short. *Anther* narrowly ovate with a prominent central rib, 4-celled. *Pollinia* 4, obovoid, laterally compressed, caudicles granulose. *Rostellum* apical, slit. *Nectary* penetrating the ovary up to near the base. *Capsule* not seen. NOTE: Description based only on *Karremans 5545*.

DISTRIBUTION: known only from Costa Rica.

EPONYMY: The name honors Jorge Warner, current Director of the Lankester Botanical Garden of the University of Costa Rica. With more than a decade in his position he has been paramount in the development of the research center at the garden, and in the creation and execution of the research projects, which allows for this and most other findings.

HABITAT IN COSTA RICA: Known only from the plants found on the summit of Cerro Tinuk, Costa Rica. It grows epiphytically and lithophytically in a small area of isolated "paramo", at around 2400 m elevation.

PHENOLOGY: flowering recorded at least in July.

Epidendrum jorge-warneri belongs to the Ramosum Group which is characterized by the monopodial, branching stems, the spike-like, distichous inflorescence, and the single callus, and the Rugosum Subgroup which has a branching habit with few-flowered inflorescences from short, secondary stems, the leaf-sheaths rugose. The species can be recognized by the laterally compressed stems, the laterally compressed rachis and ovary, the 2-4, large, brownish-yellow flowers and the lip which embraces the column completely and the "Y" shaped callus of the lip.. *Epidendrum anoglossoides* Ames & C.Schweinf. is the most similar species, but it has much smaller, up to 9, greenish-yellow flowers, sepals and petals 7.5-9.5 mm long, lip 6 mm long, and callus of the lip tri-dentate.

2. *Lepanthes ankistra* Luer, *Orquideología* 16(3): 12. 1986.

TYPE: Panama. Prov. of Chiriquí: epiphytic in cloud forest on Cerro Colorado, alt. 1500 m, 15 February 1985, C. Luer, J. Luer, R.L. Dressler & K. Dressler 10534 (holotype, MO).

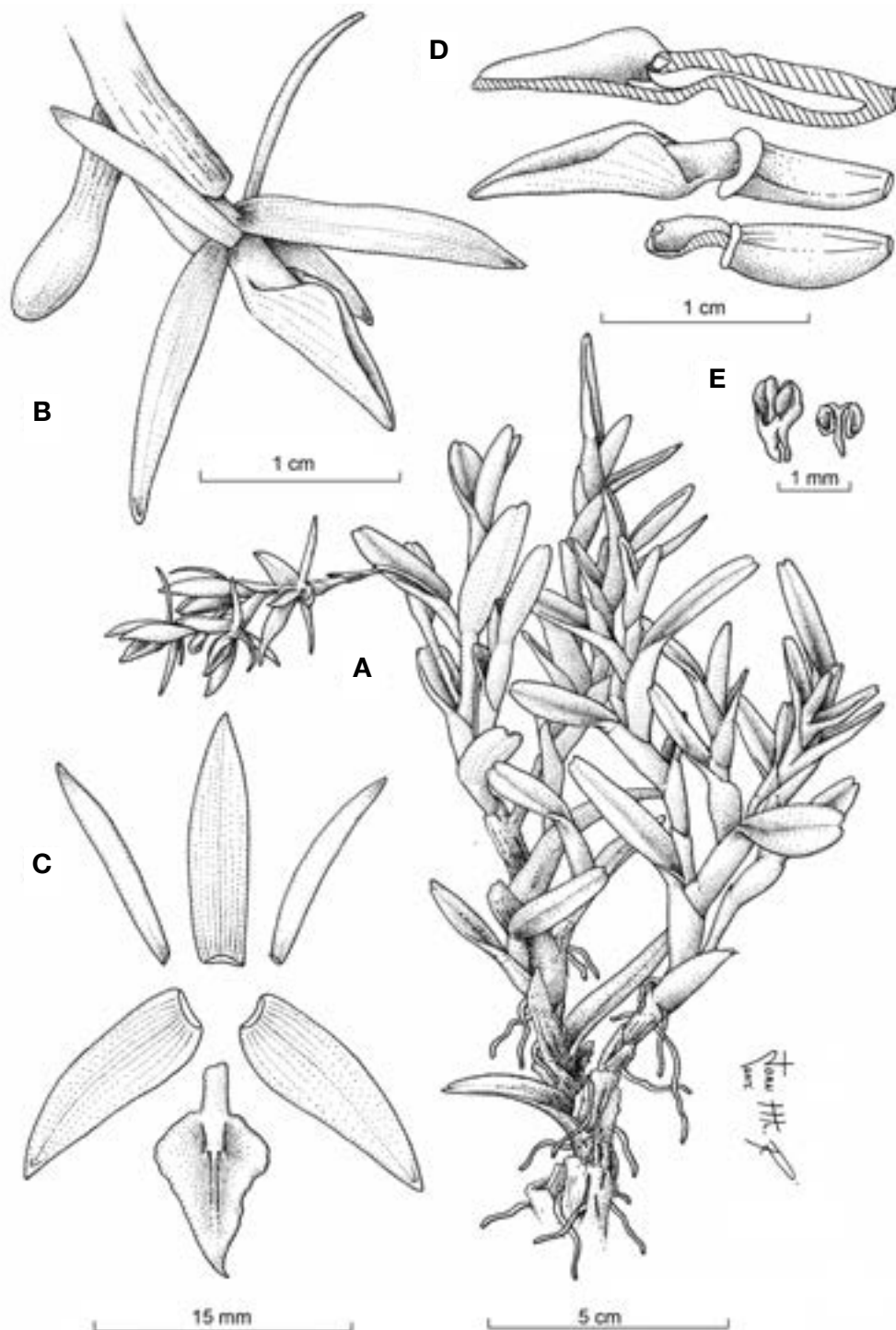


FIGURE 1. *Epidendrum jorge-warneri* Karremans & Hágsater. A — Habit. B — Flower. C — Dissected perianth, flattened. D — Column and lip, lateral view. E — Anther and pollinaria. Drawn by A.P. Karremans and J.M. Ramírez based on A.P. Karremans 5545 (JBL-Spirit).

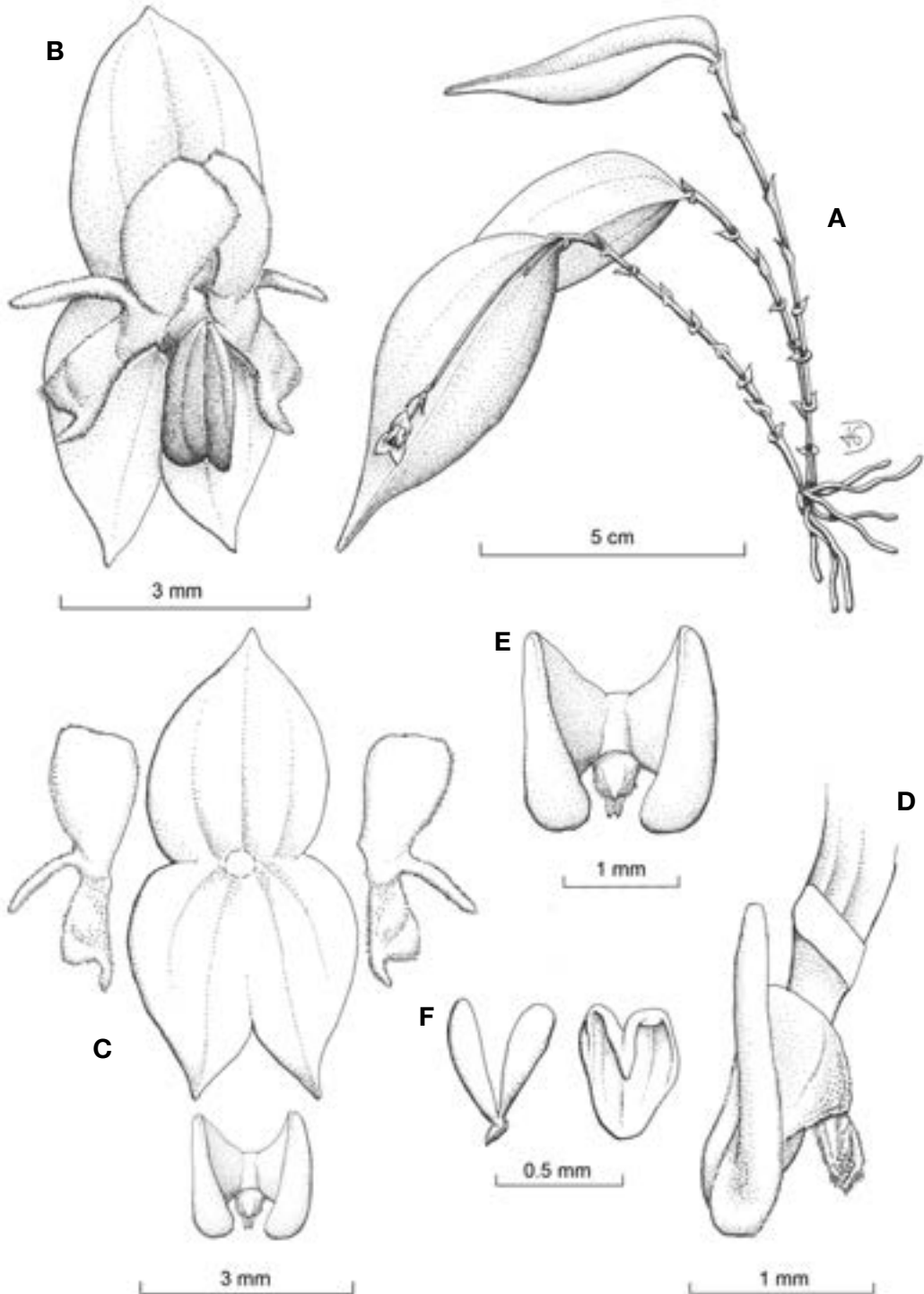


FIGURE 2. *Lepanthes ankistra* Luer & Dressler. A — Habit. B — Flower. C — Dissected perianth, flat. D — Column and lip, lateral view. E — Lip, spread. F — Pollinarium and anther cap. Drawing by D. Bogarín and D. Jiménez based on D. Bogarín 9698.

DISTRIBUTION: endemic to the Cordillera de Talamanca in southern Costa Rica and western Panama.

ETYMOLOGY: from the Greek *ankistra*, “fish-hooks” in allusion to the shape of the lower lobes of the petals.

HABITAT IN COSTA RICA: epiphytic in premontane wet forest, on the Pacific watershed of the Cordillera de Talamanca from 1500 to 2147 m of elevation. Plants were found growing in primary oak forest.

PHENOLOGY: Plants were recorded in flower in June and July.

COSTA RICAN MATERIAL STUDIED: Puntarenas: Coto Brus, Sabalito, Zona Protectora Las Tablas, 13 km al noreste de Lucha, Sitio Coto Brus, Finca de la familia Sandí-Hartmann, camino hacia la frontera Costa Rica Panamá, 8°57'15.5" N 82°43'50.6" W, 2147 m, floreció en cultivo de Daniel Jiménez, 12 julio 2012, *D. Bogarín 9698* (JBL-Spirit!; figs. 2, 14B). COSTA RICA-PANAMÁ. Puntarenas-Bocas del Toro: Coto Brus-Valle del Risco, línea fronteriza sobre la divisoria de las ingresando por el camino de la Finca Sandí-Hartmann “El Capricho”, 8°57'12.34"N 82°43'32.69"W, 2154 m, bosque pluvial montano bajo, 11 Diciembre 2013, *D. Bogarín 10741*, *A. Karremans*, *M. Fernández* & *L. Sandoval* (JBL-spirit!).

Among the Costa Rican *Lepanthes*, *L. ankistra* is recognized by the hanging, dark green-purple leaves with mucronate apices. The inflorescences lie upon the surface of the leaves, within the central groove. The flowers have pubescent petals with transverse setiform lobes at the base of the upper and lower lobes with sharply uncinuate lower lobes. The lip lobes are hiding the column and the appendix is oblong, pubescent, scaphoid and conspicuous. This species is closely related to *L. brunnescens* Luer, an endemic to Cerro Jefe in central Panama, but the latter species lacks the uncinuate lobes of the lower lobes of the petals. These *Lepanthes* species are unusual in Costa Rica. They are indeed closely allied to the South American *L. mucronata* Lindl., one of the most frequent species of the genus in the Andes (Luer 1996). Besides *L. mucronata*, there are at least 17 species from South America that may be related to *L. ankistra* and *L. brunnescens* (Luer 1996). The transverse setiform lobes at the base of the upper

and lower lobes, the lip lobes united and hiding the column and the variously pubescent, scaphoid appendices may group all those species.

3. *Lepanthes otopetala* Luer, Lindleyana 6: 76. 1991.

TYPE: Panama. Chiriquí, collected by A. Maduro, without locality, flowered in cultivation by J & L Orchids, Easton, CT, May 1990, *C. Luer 14741* (holotype, MO).

DISTRIBUTION: endemic to the Cordillera de Talamanca in southern Costa Rica and western Panama.

ETYMOLOGY: from the Greek *otopetalon*, “an ear-like petal” in allusion to the ear-like upper lobes of the petals.

HABITAT IN COSTA RICA: epiphytic in lower montane wet forest, on the Pacific watershed of the Cordillera de Talamanca at around 2400 m of elevation. Plants were found growing on primary oak forest.

PHENOLOGY: Plants were recorded in flower in April and May.

COSTA RICAN MATERIAL STUDIED: Puntarenas-Chiriquí: Coto Brus-Renacimiento, línea fronteriza hacia el Cerro Pando, después del mojón N.338, 8°55'11.22"N 82°43'18.18"W, 2446 m, bosque muy húmedo montano bajo, epífitas en bosque primario, 19 abril 2011, *D. Bogarín 8715*, *D. Jiménez* & *A.P. Karremans* (JBL-Spirit!; figs. 3, 14c).

This species shares features with the members of the *Lepanthes disticha* Garay & R.E. Schult. complex such as the erect plants, blackish amplexant lepanthiform bracts, the convex, elliptic leaves and inflorescences developed beneath the leaf. However, the matt dark purple leaves, the whitish flowers, denticulate sepals, ciliate lip blades and the conspicuous ear-like upper lobe of the petals, which is longer and wider than the lower lobe easily distinguish this species (Luer 1991). The voucher cited here was collected along the border of Costa Rica and Panama.

4. *Lepanthes truncata* Luer & Dressler, Orquideología 16(3): 9. 1986.

TYPE: Panama. Prov. of Bocas del Toro: epiphytic in wet forest between Fortuna and Chiriquí Grande,

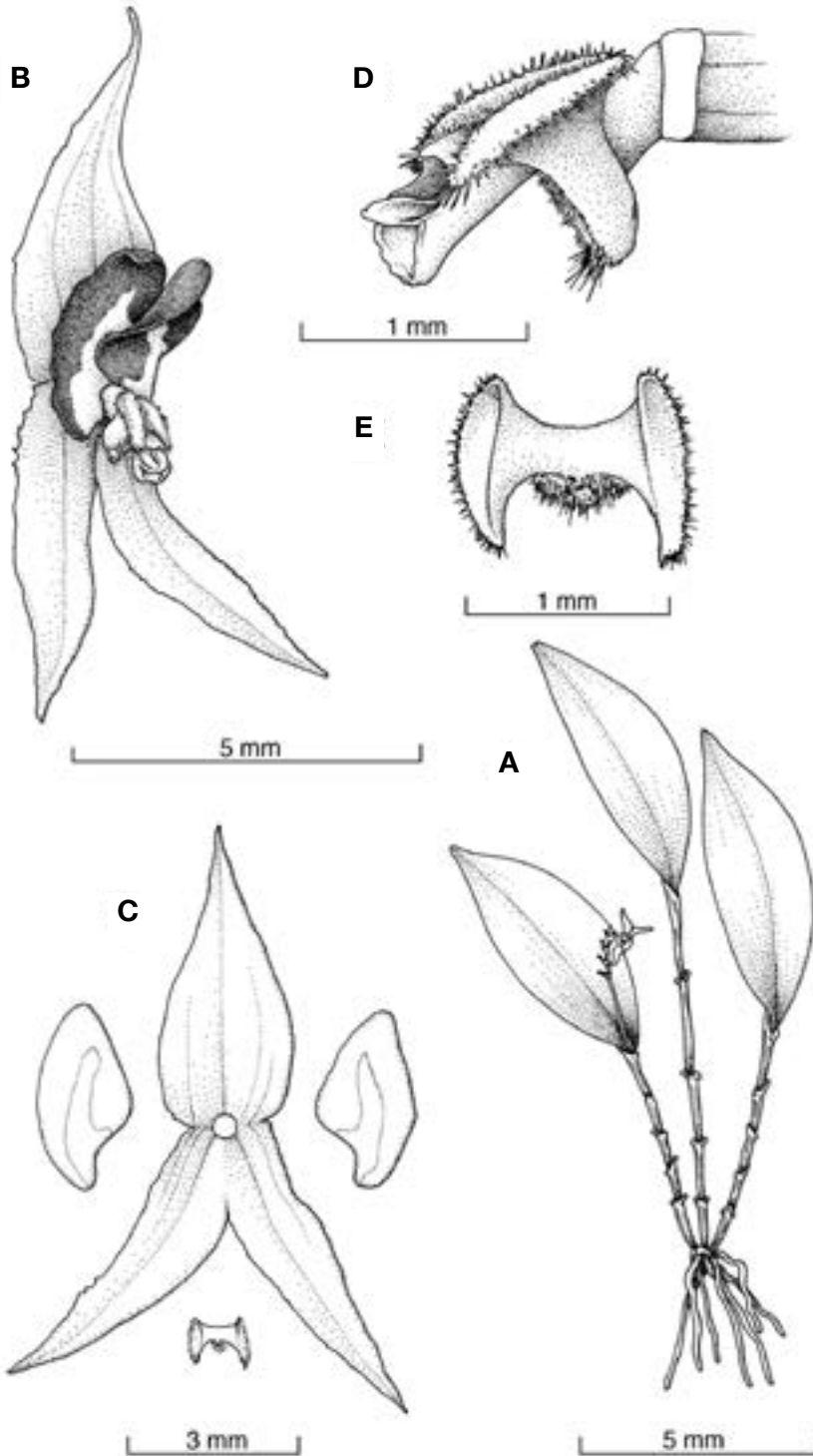


FIGURE 3. *Lepanthes otopetala* Luer. A — Habit. B — Flower. C — Dissected perianth, flat. D — Column and lip, lateral view. E — Lip, spread. Drawing by D. Bogarín and D. Solano based on D. Bogarín 8715.

alt. 350 m, 17 February 1985, C. Luer, J. Luer, R.L. Dressler & K. Dressler 10618 (holotype, MO).

DISTRIBUTION: endemic to the Caribbean lowlands of Costa Rica and Panama.

ETYMOLOGY: from the Latin *truncatus*, “truncate” in allusion to the truncate apex of the upper lobes of the petals.

HABITAT IN COSTA RICA: epiphytic in premontane rain forest, on the Caribbean watershed of the Cordillera de Talamanca below 400 m of elevation.

PHENOLOGY: Plants were recorded in flower from May to October.

COSTA RICAN MATERIAL STUDIED: Cartago-Limón: Turrialba y Siquirres, Pacuarito-Tayutic, Parque Nacional Barbilla, sendero hacia el Río Dantas (Venado), 9°58'27.35"N 83°27'00.33"W, 382 m, bosque pluvial premontano, epífitas en bosque primario y secundario, 25 mayo 2012, D. Bogarín 9652, A.P. Karremans & J. Sharma (JBL-Spirit!; figs. 4, 14D–E).

This species is recognized by the pendent plants with satiny leaves, the inflorescence is developed above the leaf, the flowers have entire, yellowish sepals and petals and the lip is reddish-pink with the blades separated, not hiding the column, and the appendix is minute, pubescent. As noted by Luer & Dressler (1986), the most distinctive character of *L. truncata* is the broadly truncate apex of the upper lobe of the petals.

5. *Platystele catiensis* Karremans & Bogarín, *sp. nov.*

TYPE: Cartago: Turrialba, Turrialba, Campus del Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), orillas del Río Reventazón, 9°53'38"N 83°38'55.5"W, 639 m, bosque muy húmedo premontano, epífitas bosque secundario detrás del edificio principal, 24 Mayo 2012, A. P. Karremans 5442, D. Bogarín & J. Sharma (holotype, JBL-Spirit!; isotype, JBL-Spirit!; figs. 5, 14F).

Species haec P. oxyglossa (Schltr.) Garay similis, sed floribus minoribus, petalis et labello quam sepalis aequilonguis, minutissime glandulosis, acutis, labello ovato-elliptico glanduloso differt.

Plant minuscule, epiphytic, caespitose, erect, up to 2.0 cm tall, including the inflorescence. *Roots* basal, flexuous, filiform. *Ramicauls* erect, slender, 1-2 mm long, enclosed by tubular, imbricating, slightly compressed, membranous sheaths, becoming brownish and papery with age. *Leaf* elliptic, erect, conduplicate, subacute, emarginate, abaxially keeled and terminating in a short apiculus, 5-8 × 2-3 mm, narrowed at the base into a conduplicate petiole. *Inflorescence* racemose, distichous, successively flowered, with one flower open at a time, up to 1.2-1.3 cm long, peduncle to 6-8 mm long, pedicels 1.0-2.0 mm long. *Floral bracts* acute, conduplicate, to 0.5 mm long. *Ovary* terete, smooth, to 0.4 mm long. *Flowers* sepals and petals transparent yellowish-green, lip and column reddish-orange, about 4.5 mm in diameter. *Dorsal sepal* narrowly lanceolate-elliptic, spreading widely, acute to shortly acuminate, marginally glandulose, 2.2-2.3 × 0.7 mm. *Lateral sepals* subequal to the dorsal sepal, lanceolate-elliptic, spreading widely, acute to shortly acuminate, marginally glandulose, 2.0-2.1 × 1.0 mm. *Petals* spreading widely, narrowly elliptic-lanceolate, acute to shortly acuminate, margins glandulose, 1-veined, 2.1 × 0.4 mm. *Lip* ovate-elliptic, shortly acuminate, glandular-hirsute, especially at the apex, with a small glenion at the base, 1.5 mm × 0.7 mm. *Column* short, sub-cylindrical, 0.4 mm long. *Anther* apical, *stigma* subapical, transversely bilobed at each side of the anther. *Pollinia* 2, ovoid. NOTE: Description based on Karremans 30, 5442, 5443 and Bogarín 9661.

PARATYPES: Costa Rica. Cartago: Turrialba, Turrialba, CATIE, río Reventazón, tramo Bajo del Chino-Espaveles. 9°53'44" N 83°39'27" W, 600 m, 30 de enero del 2004, A.P. Karremans 30 & J. Velásquez (JBL-Spirit!). Turrialba, Turrialba, Campus del Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), orillas del Río Reventazón, 9°53'38"N 83°38'55.5"W, 639 m, bosque muy húmedo premontano, epífitas bosque secundario detrás del edificio principal, 24 mayo 2012, A. P. Karremans 5443, D. Bogarín & J. Sharma (JBL-Spirit!). Cartago-Limón: Turrialba y Siquirres, Pacuarito-Tayutic, Parque Nacional Barbilla, sendero hacia el Río Dantas (Venado), 9°58'27.35"N 83°27'00.33"W, 382 m, bosque pluvial premontano, epífitas en bosque primario y secundario, D. Bogarín 9661, A.P. Karremans & J. Sharma, 25 Mayo 2012

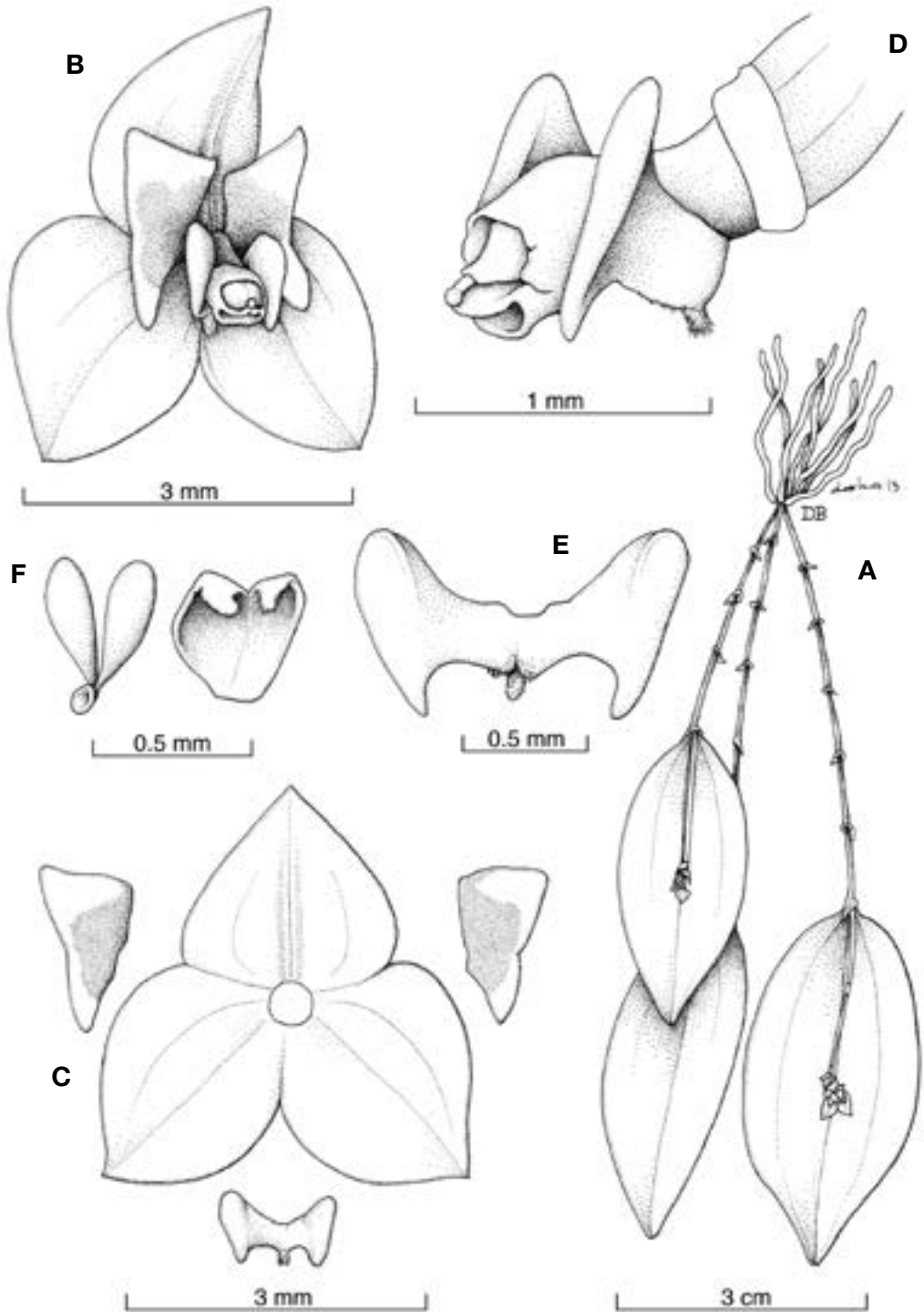


FIGURE 4. *Lepanthes truncata* Luer & Dressler. A — Habit. B — Flower. C — Dissected perianth. D — Column and lip, lateral view. E — Lip, spread. F — Pollinarium and anther cap. Drawing by D. Bogarín and D. Solano based on D. Bogarín 9652.

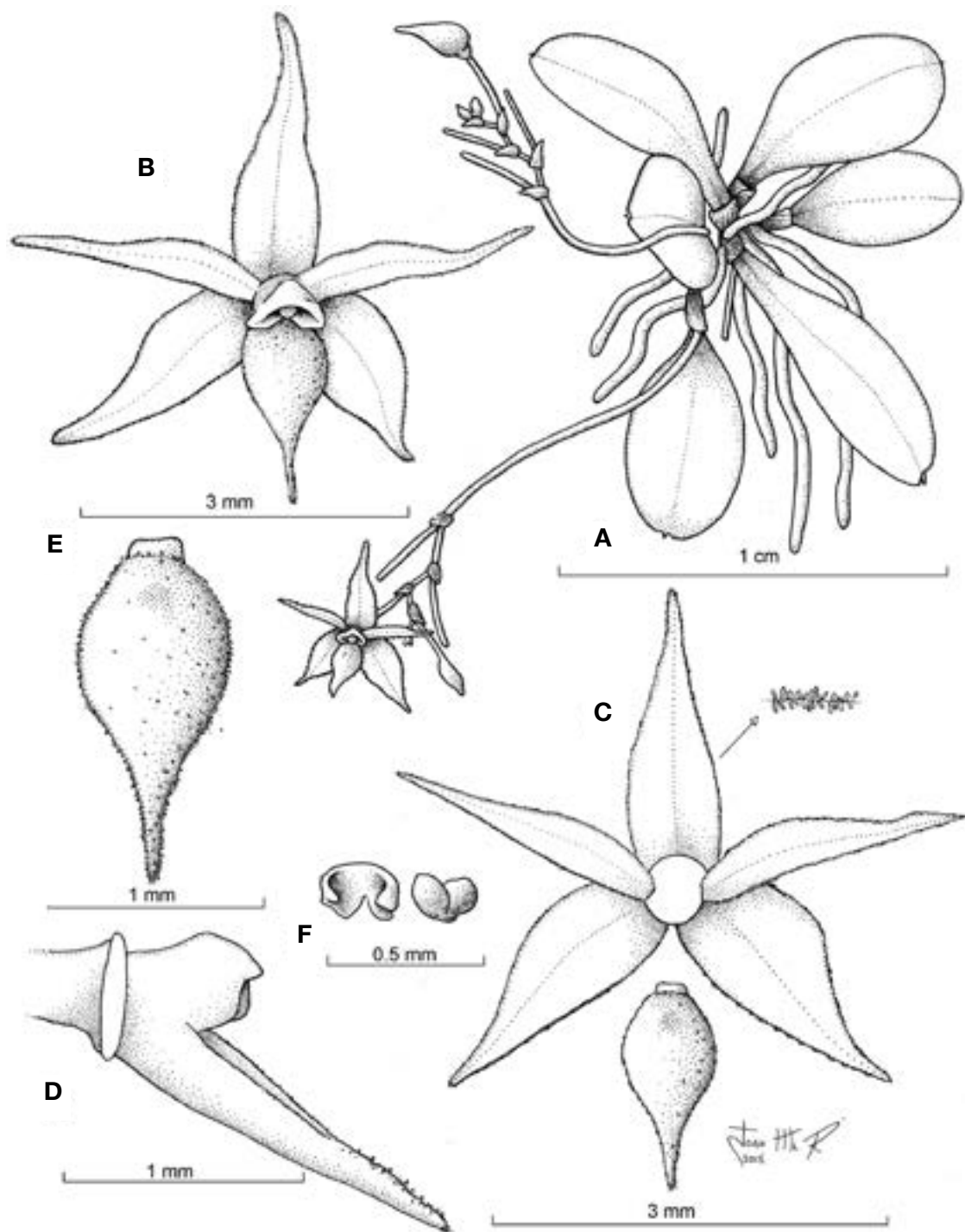


FIGURE 5. *Platystele catiensis* Karremans & Bogarín. A — Habit. B — Flower. C — Dissected perianth. D — Column and lip, lateral view. E — Lip, spread. F — Pollinarium and anther cap. G — Sepal margin. Drawing by D. Bogarín and J.M. Ramírez based on A.P. Karremans 5442 (JBL-Spirit).

(JBL-Spirit!). Heredia: Sarapiquí, Puerto Viejo, Finca La Selva, 3 km SE of Puerto Viejo de Sarapiquí, 50-150 m, 22 Nov. 1979, *C. Todzia 1035* (CR!). Sarapiquí, Puerto Viejo, Estación Biológica La Selva, OTS field station near junction of Puerto Viejo and Sarapiquí rivers. Elevation 40-100 m. Camino Circular Lejano (CCL) 950. 11 Mar. 1991, *K. Richardson* (CR!). Sarapiquí, Puerto Viejo, Estación Biológica La Selva, at the confluence of Río Sarapiquí and Río Puerto Viejo, Atlantic slope. 10°26'00"N 84°01'00"W, 50-100 m, growing on twigs near major treefall along Camino Circular Lejano, 12 Oct. 1990, *M. Grayum 9994* (INB!). Limón: shores of Caño Perreira; periodically inundated swamp forest, Piora dominant. 20 Mar. 1897, *W.D. Stevens, G. Herrera & O.M. Montiel 25151* (INB!; MO).

OTHER RECORDS: Costa Rica. Heredia: Sarapiquí, Puerto Viejo, Estación Biológica La Selva, *O. Vargas 2148* (Digital Photograph!).

DISTRIBUTION: known only from Costa Rica.

ETYMOLOGY: the name honors the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), where this species was first observed by the authors. CATIE is, like Lankester Botanical Garden, celebrating its 40th Anniversary in 2013.

HABITAT IN COSTA RICA: epiphytic in primary and mature secondary humid premontane forest, at around 300-650 m elevation. It is known from the Caribbean lowlands, especially the Sarapiquí, Siquirres and Turrialba areas. The species grows on the protected dense mature vegetation right behind the main building of CATIE, where it is found on small branches that fall from the large trees in the "Espaveles" path, which descends to the Turrialba-Reventazón river. Likewise on the path that descends to Dantas river in the Barbilla National Park.

PHENOLOGY: flowering recorded from January to October, however it is likely it flowers all year round.

Platystele catiensis has been confused in Costa Rica with the apparently widely distributed and variable *P. oxyglossa*. The latter is also found in the country (Luer 1990), but *P. catiensis* is typically found growing below elevations of 650 m in the Caribbean lowlands (vs. growing at an elevation of 1000-2500 m in the Central and Talamanca Cordillera), it has a much smaller plant

that grows up to 2 cm including the inflorescence (vs. 6 cm tall), a denser and shorter inflorescence which is up to 1.3 cm long (vs. a stinging inflorescence up to 5 cm long), with 1.0-2.0 mm long pedicels (pedicels 2.5-7.0 mm long), with less than 5 mm between each one (distance between pedicels 2.0-5.0 mm long), and smaller flowers with sepals and petals up to 2.3 mm long (vs. up to 3.5 mm long), and the lip up to about 1.5 mm long (vs. 2.5 mm long). From the Guatemalan type material of *P. oxyglossa*, *P. catiensis* can be distinguished by the shorter (2.2-2.3 mm), shortly acuminate and marginally glandular sepals (vs. sepals 2.5 mm, long acuminate, glabrous), the petals and lip are longer, subequal to the sepals, the petal margin is glandular, while the lip is elliptic, and completely glandular-hirsute, especially near the apex (vs. sepals and lip 1.5 mm, much shorter than the sepals, and are glabrous, the lip is ovate-lanceolate). It might well turn out that none of the Costa Rican material can be referred to *P. oxyglossa*. In that case the larger species found in the Central Cordillera should be referred to as *Platystele schulzeana* (Schltr.) Garay, described from La Carpintera. For the time being we only segregate the easily distinguished and morphologically constant *P. catiensis*, and point out that the name *P. oxyglossa* has been applied to two different species in Costa Rica. A few Brazilian species have been placed under synonymy of *P. oxyglossa*, but from what we have seen they are most likely not the same species, and certainly are not the same as those found in Costa Rica. The recently described *Platystele paraensis* Campacci & da Silva has the typical general flower morphology of the *P. oxyglossa* complex, and is as tiny as *P. catiensis*. It can be distinguished by the single flowered inflorescence, the sepals that are long caudate, that have an orange mid-vein and are much longer than the lip, which is apically yellow-orange. Flower morphology and size is similar to *Platystele psix* Luer & Hirtz, however the Ecuadorian species has cellular-pubescent sepals and petals. Another similar species occurs in Panama and Ecuador, *Platystele taylorii* Luer can be however recognized by the lip that is long acuminate and exceeds the glabrous sepals.

6. *Platystele sylvestrei* Karremans & Bogarín, *sp. nov.*

TYPE: Costa Rica. Cartago: Paraíso, Orosi, Tapantí, Parque Nacional Tapantí, camino entre el portón del Mirador hacia el Río Humo, Proyecto

Hidroeléctrico Tapantí, 9°41'32.9"N 83°47'03.2" W, 1650 m, bosque pluvial premontano “*supra arbores et ad truncos prostratos vetustos ad sylvarum versuras ad viam flumen Humo in Tapantí*”, 18 Noviembre 2010, *D. Bogarín 8240*, *R. Gómez, A.P. Karremans, B. Klein, G. Meza & F. Pupulin* (holotype, JBL-Spirit!; fig. 6, 7).

Species haec P. oxyglossa (Schltr.) Garay similis, sed planta majore, floribus autogamus albus, sepalis petalisque angustissimis, labello angusto-ovato lanceolato differt.

Plant medium for the genus, epiphytic, caespitose, erect, up to 12-13 cm tall, including the inflorescence. *Roots* basal, flexuous, filiform. *Ramicauls* erect, slender, 5-8 mm long, enclosed by tubular, imbricating, slightly compressed, membranous sheaths, becoming brownish and papery with age. *Leaf* narrowly obovate-elliptic, erect, conduplicate, obtuse, emarginate, 20-35 × 5-7 mm, narrowed at the base into a conduplicate petiole. *Inflorescence* racemose, distichous, successively flowered, with one flower mature (not necessarily open) at a time, up to 12 cm long, peduncle to 7 cm long, pedicels 1.0-1.5 cm long. *Floral bracts* acute, conduplicate, to 1 mm long. *Ovary* terete to suborbicular, smooth, to 2 mm long (fertilized). *Flowers* cleistogamous or autogamous (at least in the material at hand), sepals and petals transparent whitish, with a violet blotch on the base of the lip and violet markings on the column, about 4 mm in diameter. *Dorsal sepal* narrowly ovate, spreading widely, acute, glabrous, 2.3-2.4 × 0.5 mm. *Lateral sepals* subequal to the dorsal sepal, narrowly ovate, spreading widely, acute, glabrous, 2.3 × 0.6-0.7 mm. *Petals* spreading widely, linear to narrowly lanceolate, acute, margin somewhat irregular, 1-veined, 2.0 × 0.2-0.3 mm. *Lip* very narrowly ovate-lanceolate, shortly acuminate, glabrous, without an evident glenion at the base, 1.6-1.7 × 0.5 mm. *Column* short, thick due to autogamy, sub-cylindrical, 0.5 mm long. *Anther* not noted, *stigma* deformed, apical. *Pollinia* not observed. *NOTE:* Description based only on *Bogarín 8240*.

PARATYPES: Costa Rica. Alajuela: San Ramón, Piedades, unpaved road from Piedades Norte to Piedades Sur, San Antonio de Zapotal, 10°09'51.9"N 84°35'36.5"W, 1410 m, Caribbean watershed of the

Continental Divide, premontane cloud forest, 24 March 2005, *F. Pupulin 5595*, *E. Salas-Pupulin, D. Bogarín & A.C. Rodríguez* (JBL-Spirit!). Puntarenas: Reserva Biológica Monteverde, Ojo de Agua, Finca de Leonel Hernández. Bosque pantanoso semiachaparrado. Lado Pacífico de la reserva. 10°15'N 84°46'W, 1600 m. 14 nov. 1987. *W. Haber & E. Bello 7808* (INB!; Illustration-INB!). Puntarenas: Monteverde Cloud Forest Reserve. Pacific slope and continental divide, road to divide, swamp along Sendero Pantanoso and Sendero Chomogo. 10°18'N 84°47'W, 1550-1600 m. Epiphyte. 14 Mar. 1990. *W. Haber & W. Zuchowski 9798* (INB!). Costa Rica - Panama: Puntarenas-Bocas del Toro: Coto Brus-Valle del Risco, línea fronteriza sobre la divisoria de aguas ingresando por el camino de la Finca Sandí-Hartmann “El Capricho”, 8°57'12.34"N 82°43'32.69"W, 2154 m, bosque pluvial montano bajo, 11 diciembre 2013, *A.P. Karremans 6130, D. Bogarín, M. Fernández & L. Sandoval* (JBL-Spirit!; fig. 7A). Same locality and date, *D. Bogarín 10744, A.P. Karremans, M. Fernández & L. Sandoval* (JBL-Spirit!; fig. 7B).

DISTRIBUTION: known only from Costa Rica and Panama.

ETYMOLOGY: El Silvestre (the uncultivated) was the name of Charles H. Lankester's farm before becoming Lankester Botanical Garden in the hands of the University of Costa Rica. This species honors the garden's 40th anniversary.

HABITAT IN COSTA RICA: epiphytic in mature humid premontane forest, between 1410 and 1650 m elevation. It is known from a few but distant localities, Tapantí National Park in Cartago, close to San Ramón in Alajuela, the Monteverde area in Puntarenas, and on both sides of the continental divide close to the Costa Rica - Panama border.

PHENOLOGY: flowering recorded at least in March and November and December, considering the successiveness of the inflorescence it is likely found flowering-fruiting all year round.

Platystele sylvestrei probably belongs to the *P. oxyglossa* species complex, however, it has a relatively large habit, reaching above 10 cm when including the inflorescence. The species can be easily recognized by

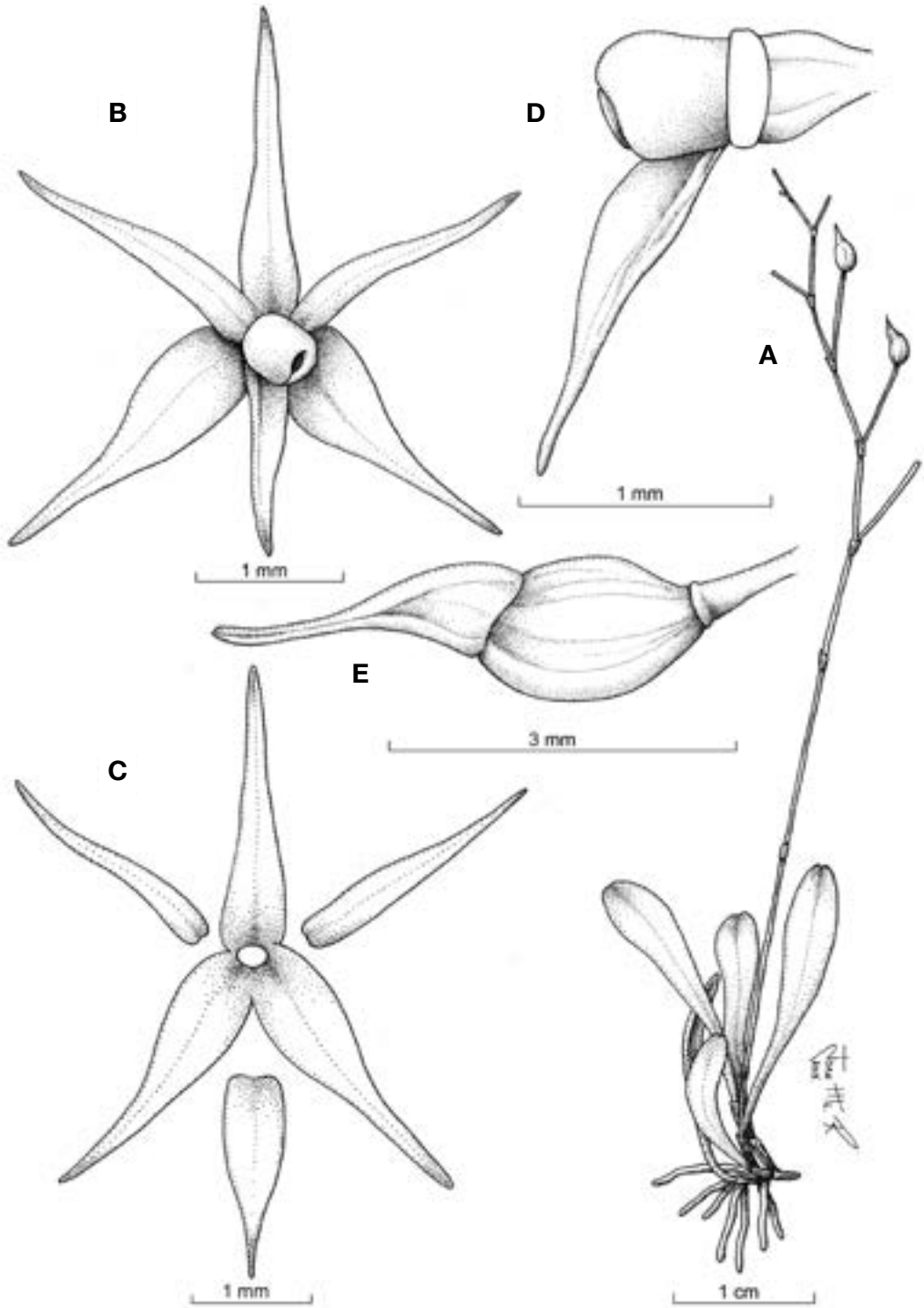


FIGURE 6. *Platystele sylvestrei* Karremans & Bogarín. A — Habit. B — Flower. C — Dissected perianth. D — Column and lip, lateral view. E — Fruit with persistent perianth, lateral view. Drawing by D. Bogarín and J.M. Ramírez from D. Bogarín 8240 (JBL-Spirit).

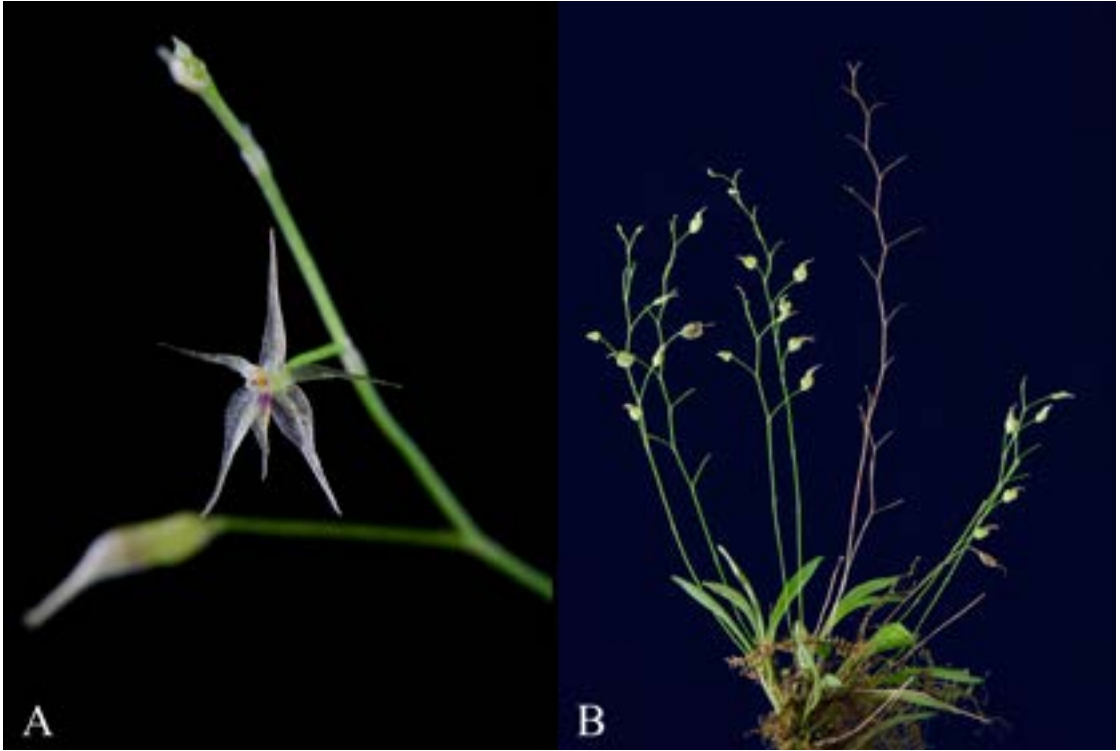


FIGURE 7. *Platystele sylvestrei* Karremans & Bogarín. A — A rare case of a fully opening flower, already pollinated (Karremans 6130). B — Plant habit showing the long lax inflorescences with the characteristic fruiting (Bogarín 10744). Photographs by A.P. Karremans (A) and D. Bogarín (B).

the lax inflorescence, the long pedicels, the whitish-transparent, autogamous/cleistogamous flowers and the narrow, glabrous flower segments, with a narrowly ovate-lanceolate lip.

7. *Platystele tica* Karremans & Bogarín, *sp. nov.*

TYPE: Costa Rica. Puntarenas: Buenos Aires, Volcán, 09°13'N, 83°26'W, ca. 450 m, bosque muy húmedo premontano transición a basal en bosque secundario muy alterado a orillas de un riachuelo, 17 de abril 2012, A.P. Karremans 5315, J. Cambroner & J. Geml (holotype, JBL-Spirit!; isotype, JBL-Spirit!; figs. 8, 9, 14G–H).

Species haec P. oxyglossa (Schltr.) Garay *similis*, sed *planta minutissima, floribus minutissimis flavis, sepalis petalisque acutis latiores, labello ovato acuto differt.*

Plant minuscule, epiphytic, caespitose, erect, up to 2.0 cm tall, including the inflorescence. *Roots* basal, flexuous, filiform. *Ramicauls* erect, slender, 1-2 mm long, enclosed by 2-3 tubular, imbricating,

slightly compressed, membranous sheaths, becoming brownish and papery with age. *Leaf* elliptic, erect, fleshy, coriaceous, conduplicate, subacute, emarginate, abaxially keeled and terminating in a short apiculus, 5-7 × 1.5-2.5 mm, narrowed at the base into a conduplicate petiole. *Inflorescence* racemose, distichous, successively flowered, with one flower open at a time, up to 1.5 cm long, peduncle to 1.2 cm long, pedicels 1.5-2.0 mm long. *Floral bracts* acute, conduplicate, to 0.5-0.8 mm long. *Ovary* terete, smooth, to 0.3 mm long. *Flowers* monochrome yellow, about 1.8 mm in diameter. *Dorsal sepal* narrowly ovate-elliptic, spreading widely, acute, glabrous, 0.9 × 0.5 mm. *Lateral sepals* subequal to the dorsal sepal, broadly elliptic, spreading widely, acute, glabrous, 0.9 × 0.7 mm. *Petals* spreading widely, narrowly elliptic-lanceolate, acute, margins irregular, 1-veined, 0.9 × 0.3 mm. *Lip* ovate, shortly acuminate, glandular, especially at the apex, margin irregular, with a small glenion at the base, 0.8-0.9 × 0.4-0.5 mm. *Column* short, sub-cylindrical, 0.3-0.4 mm long. *Anther* apical, *stigma* subapical, transversely bilobed at each

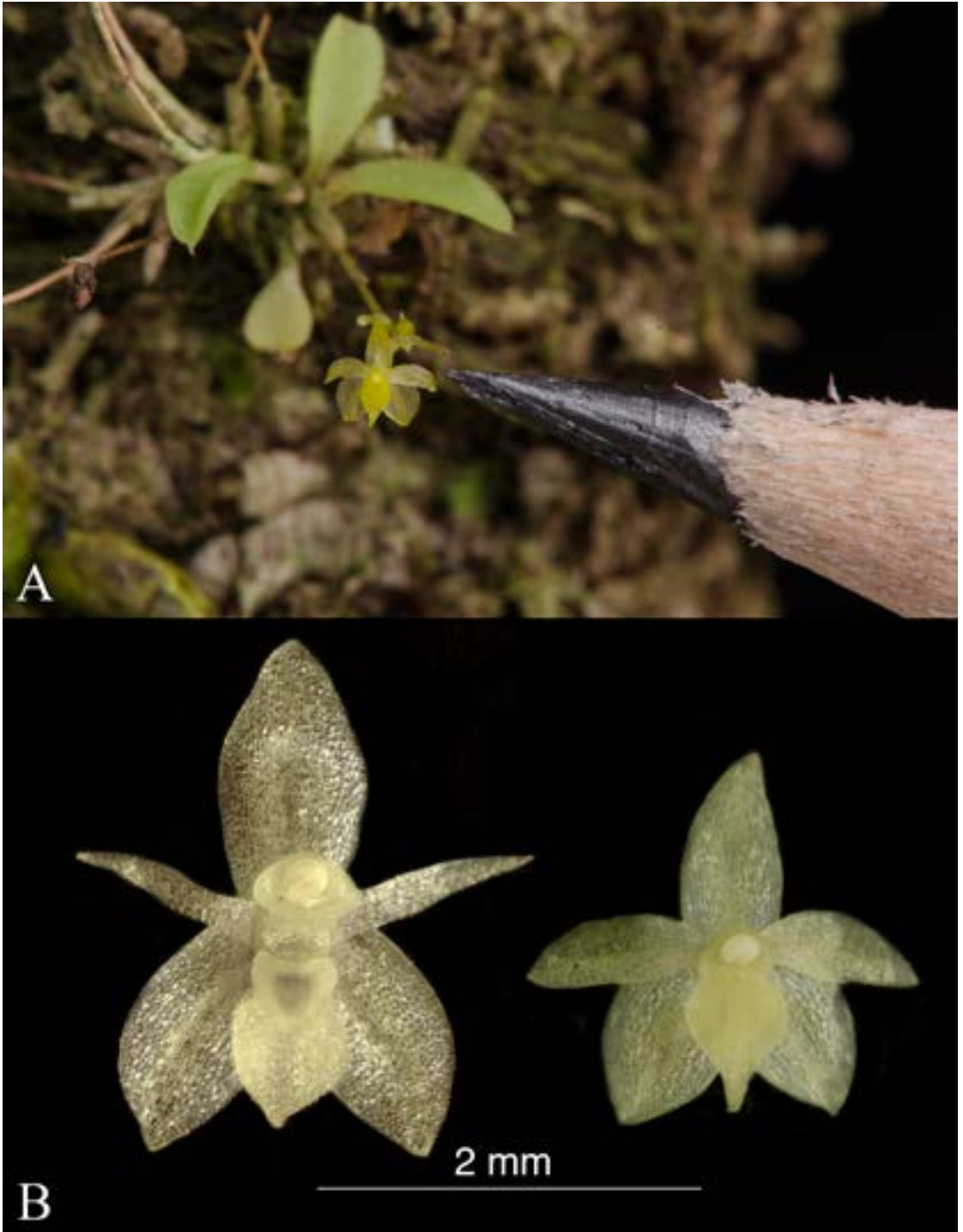


FIGURE 8. Size comparison of *Platystele tica* Karremans & Bogarín: A — The specimen that served as type material, *in situ*, compared with a pencil. B — On the left *Platystele microtatantha* (Schltr.) Garay (Bogarín 10241), on the right *Platystele tica* (Karremans 5929A). Photographs by A.P. Karremans.

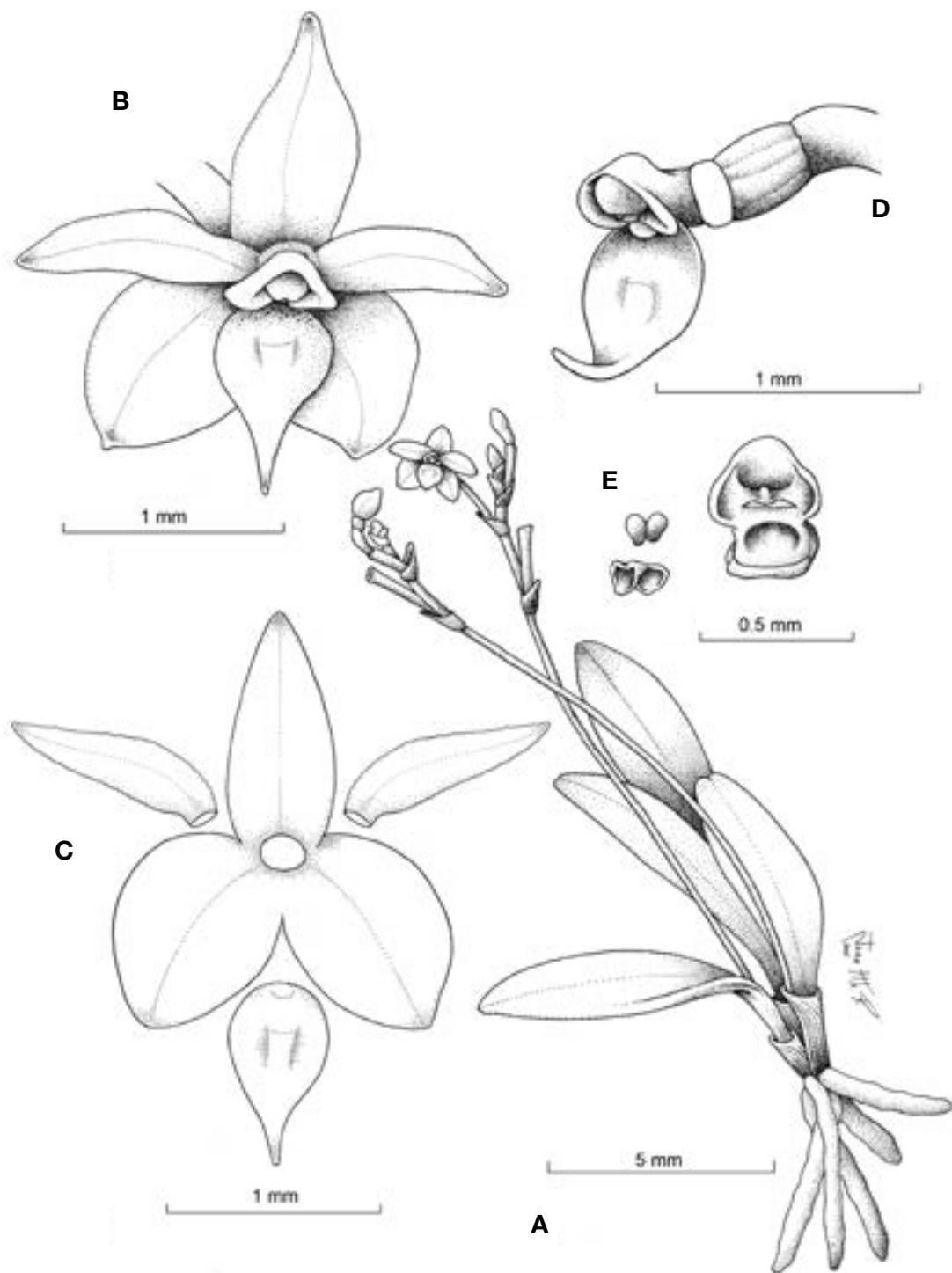


FIGURE 9. *Platystele tica* Karremans & Bogarín. A — Habit. B — Flower. C — Dissected perianth. D — Column and lip, lateral view. E — Column, front view. F — Pollinarium and anther cap. G — Sepal margin. Drawing by D. Bogarín and J.M. Ramírez based on *A.P. Karremans 5315* (JBL-Spirit).

side of the anther. *Pollinia* 2, ovoid. NOTE: Description based on *Karremans 5315, 5829A* and *Pupulin 2928*.

PARATYPES: Costa Rica. Puntarenas: Buenos Aires, Volcán, Cacao, orillas del Río Cacao en bosque secundario bajo el puente de la Carretera Interamericana, 9°13'10.441"N 83°28'19.002"W, 449 m, bosque muy húmedo premontano transición a basal, 20 marzo 2013, *A.P. Karremans 5829A, D. Bogarín, J. Cambroner & F. Pupulin* (JBL-Spirit!; figures 8 & 9). San José: Pérez Zeledón, El Brujo, road to El Llano, along the boarder of río División, 320 m, 9°25'40"N 83°54'58"W, epiphytic on tall trees along the river shore, 21 Jan. 2001, *F. Pupulin 2928, D. Castelfranco & L. Elizondo* (JBL-Spirit!).

OTHER RECORDS: Costa Rica. San José: Tarrazú. No protegida. Cuenca del Naranjo y Paquita. Valle del General, Longo May. Río Sonador, 1400-1800 m, 9°36'30"N 84°06'00"W, epífita, 16 may 2006, *J. F. Morales 13937* (INB!; INB-Spirit). Geographical distribution, plant habit and size, and flower coloration suggests that this specimen is *P. tica*, however, the flowers on the dried specimen are too damaged to tell with certainty and we were not able to locate the spirit specimen.

A text and its accompanying photographs by Pontus Aratoun featuring a *Platystele* species from Mecana beach, Choco, Colombia (available through <http://miniorchids.wordpress.com>), possibly represents the same species.

DISTRIBUTION: known only from Costa Rica. It may also be present southwards into Colombia.

EPONYMY: the name honors Costa Rica, country where this minuscule species was found, and the people of which are known as *tico* and *tica*. The nickname *tico* or *tica* comes from the Costa Rican linguistic custom of using it as a diminutive suffix, alluding thus as well to the small size of this *Platystele*.

HABITAT: epiphytic in secondary forest in premontane wet forest, between about 300 and 450 m (1400-1800 m?) elevation. It is known only from the Costa Rican south-Pacific, in the Valle de El General area.

PHENOLOGY: flowering recorded at least from April to June, however considering the slowly successive inflorescences, each is likely to flower continuously for months at a time.

Platystele tica is without obvious close relatives in Costa Rica. General plant morphology would suggest affinity with the *P. oxyglossa* group, as does the lip shape. The new species, however, lacks the typical caudate sepals and the reddish-purplish coloring of the lip. Flower coloration and size are somewhat reminiscent of *Platystele minimiflora* (Schltr.) Garay, however that species has a creeping habit. *P. tica* has one of the smallest flowers in the genus rivaled only by that of *P. enervis* Luer, *P. ornata* Garay and *P. umbellata* P.Ortiz. It makes the previous Costa Rican famous dwarfs, *P. jungermannioides* (Schltr.) Garay and *P. microtatantha* (Schltr.) Garay, look large. This species might not necessarily be rare, we have observed at least a couple of specimens more in the field and photographed by enthusiasts, but considering the minuscule size of the plant and flower, the lack of herbarium collections and habitat loss in the area it grows, it is not unsurprising that it had escaped description.

8. *Ponthieva villosa* Lindl., Pl. Hartw. 155. 1845.

TYPE: Ecuador. *In montibus Paccha rarissima, T. Hartweg s.n.* (holotype: K). Syn. *Ponthieva crinta* Garay, Fl. Ecuador 9: 214. 1978 (AMES!).

DISTRIBUTION: Costa Rica, Colombia, Ecuador and Peru.

ETYMOLOGY: from the Greek κύστις, “bladder”, “cyst” in reference to the prominent ventral vesicle behind the perianth.

HABITAT IN COSTA RICA: the only known specimen was found growing as an epiphyte on a roadside close to Tapantí National Park, in sub montane wet forest, at about 1500 m.

COSTA RICAN MATERIAL STUDIED: Cartago: Paraíso, Orosi, Tapantí, sobre el camino a Tausito, unos 4 km del cruce al Parque Nacional Tapantí, 9°46'27.82"N 83°46'54.57" W, 1513 m, epífitas sobre árboles al lado de la calle, bosque pluvial premontano, 12 de febrero 2012, *A.P. Karremans 5040* (CR!; figs. 10, 14i).

The specimen here cited was collected singly, in bloom, on a roadside of a frequented collecting site, and was initially thought to be a novelty. However, the illustrations of *Ponthieva villosa* from Ecuador

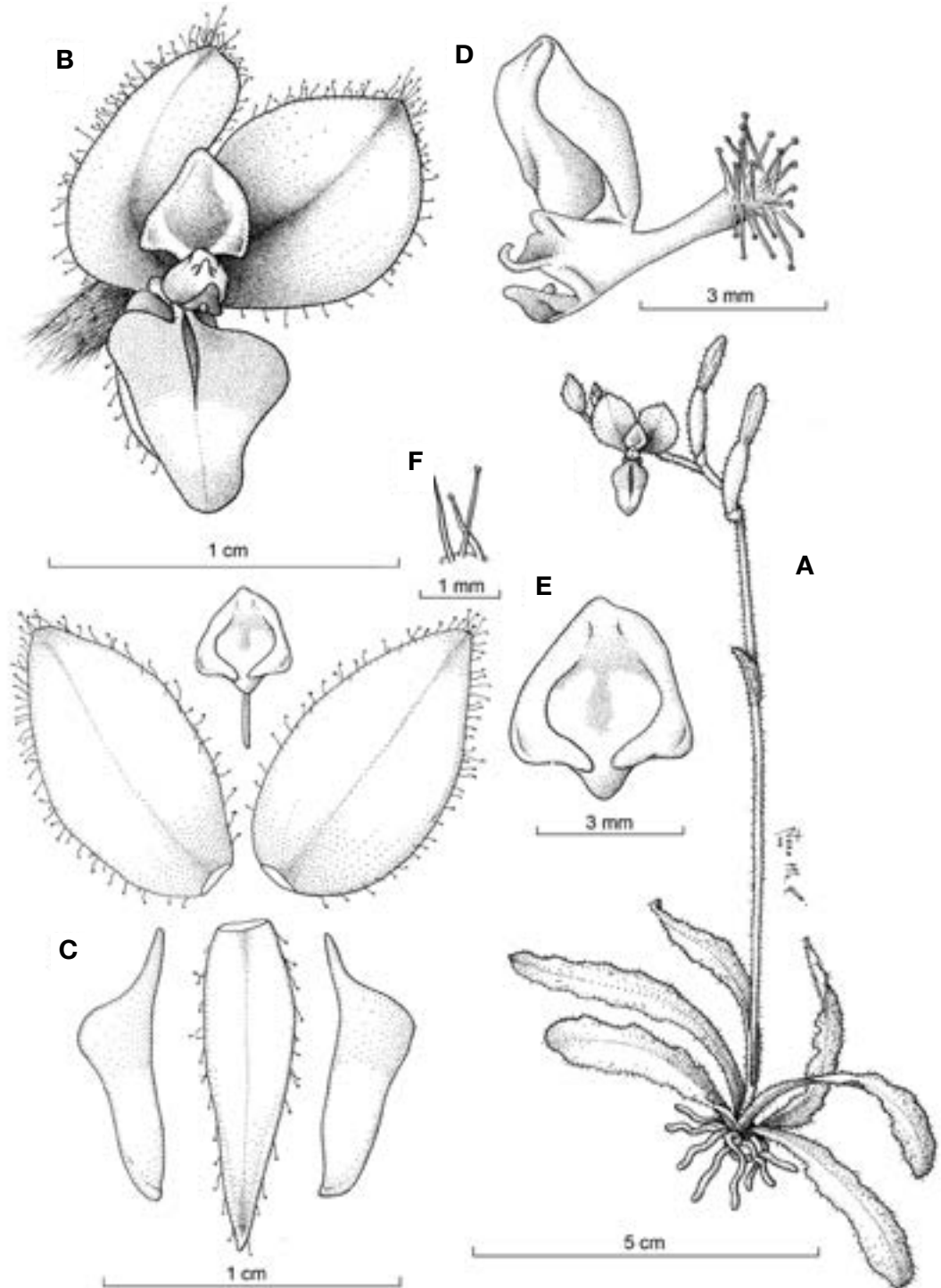


FIGURE 10. *Ponthieva villosa* Lindl. A — Habit. B — Flower. C — Dissected perianth. D — Column and lip, lateral view. E — Lip. F — Capitulate hairs of the sepal margins. Drawn by A. P. Karremans and J. M. Ramírez from A.P. Karremans 5040 (JBL-Spirit).

in Dodson and Dodson (1989) and from Colombia in Ortiz (1991), and the type specimen of *P. crinita* (which has been considered a synonym of *P. villosa*), are so similar to the Costa Rican plant that we are unable to distinguish them with the material and information at hand. Unfortunately not much is known about *P. villosa* in general, the original description is quite superficial and we have not been able to see the holotype. The specimen collected close to Tapantí is in any case a species morphologically quite distinct to any previously reported species of *Ponthieva* from Costa Rica, and for now will bear the name *P. villosa*. It can be recognized by the epiphytic plants that are completely hirsute, from the leaves to the back of the sepals. The leaves are quite narrow, with the margins undulate. The sepals are greenish, while the petals are yellowish-green with a large white spot above the middle. The lateral sepals are almost entirely free. The lip is prominently concave and glossy.

9. *Restrepia aberrans* Luer, *Orquideología* 20(2): 117. 1996.

TYPE: Panama. Bocas del Toro, epiphytic in forest above Chiriquí Grande, alt. 350 m, 17 Feb 1985, collected by C. Luer, J. Luer, R. Dressler & K. Dressler, flowered in cultivation by A. & P. Jesup in Bristol, CT., 26 Apr 1987, *C. Luer 10612* (holotype, MO).

DISTRIBUTION: Costa Rica and Panama.

ETYMOLOGY: from the Latin *aberrans*, “aberrant”, referring to unusual floral features that occur in no other species of the genus (Luer 1996).

HABITAT IN COSTA RICA: Known only from the premontane wet forests of Costa Rican Atlantic watershed between 350 m to 790 m of elevation, growing on branches of *Ficus* sp.

COSTA RICAN MATERIAL STUDIED: Cartago: Jiménez, Pejibaye, La Marta, laderas del río Gato. Reserva Biológica La Marta, sendero Tepemechines, creciendo en ramas de *Ficus* sp. 9°46'52"N 83°41'15"W, 790 m, colectada por Daniel Jiménez en mayo del 2012, *A.P. Karremans 5069* (JBL-Spirit!; figs. 11, 14).

Restrepia aberrans can be recognized by the narrowly triangular dorsal sepal, concave at the base,

the lateral sepals partially connate with erect sides towards the base, the parallel petals slightly widened at the apex, the trilobed lip with the lateral lobes erect, oblique, and two inner, erect blades; the column is half the length of the lip, widened towards the apex.

The specimen here cited was found growing in the premontane wet forest of La Marta Wildlife Refuge, located in the Costa Rican Atlantic lowlands. Based on the available literature, the only specimen known before this record was that of the type specimen, which was coincidentally found in the Atlantic lowlands of western Panama, near the border with Costa Rica. Opposed to the type specimen, no evidence of cleistogamy was observed in the Costa Rican plant. Likewise, the lateral sepals of the latter remained almost entirely connate until the flower decayed.

10. *Sobralia bletiae* Rchb.f., *Bot. Zeitung* (Berlin) 10: 713. 1852.

TYPE: “Chiriquí” Panama, *Warszewicz s.n.* (holotype, W).

DISTRIBUTION: Venezuela, Ecuador, Panama, Costa Rica and Nicaragua.

ETYMOLOGY: most probably refers to the similarity of the flower with those of *Bletia*.

HABITAT IN COSTA RICA: Known from the tropical wet forests of the Osa peninsula in southern Costa Rica, growing at low elevations in secondary forests.

COSTA RICAN MATERIAL STUDIED: Puntarenas: Osa, Sierpe, camino a Bahía Drake, entre Rincón y Rancho Quemado, 8°40'52.3"N 83°32'57.5"W, 214 m, en bosque secundario y cercas a orillas del camino, bosque muy húmedo tropical “*sylvas ad peninsula Osa regione sinus Dulce versus Drake prope Rancho Quemado*”, 13 marzo 2011, *D. Bogarin 8497, A.P. Karremans & J. Sharma* (JBL-Spirit!; figs. 12, 14κ); Puntarenas: Osa, P.N. Piedras Blancas, 8.69 -83.23, Estacion Rio Bonito, 100 m, *E. Fletes 424* (INB, MO); Puntarenas: Osa, Rincón de Osa. Streams and slopes adjacent to airfield, 08°42'N 083°31'W, 20 - 300 m, epiphytic in disturbed primary forest, 6-7 Feb. 1974, *R. L. Liesner 1817* (MO).

The habit of *S. bletiae* is similar to that of several other *Sobralia*, such as *S. decora* Bateman and *S. mucronata* Ames & C.Schweinf. It can be recognized

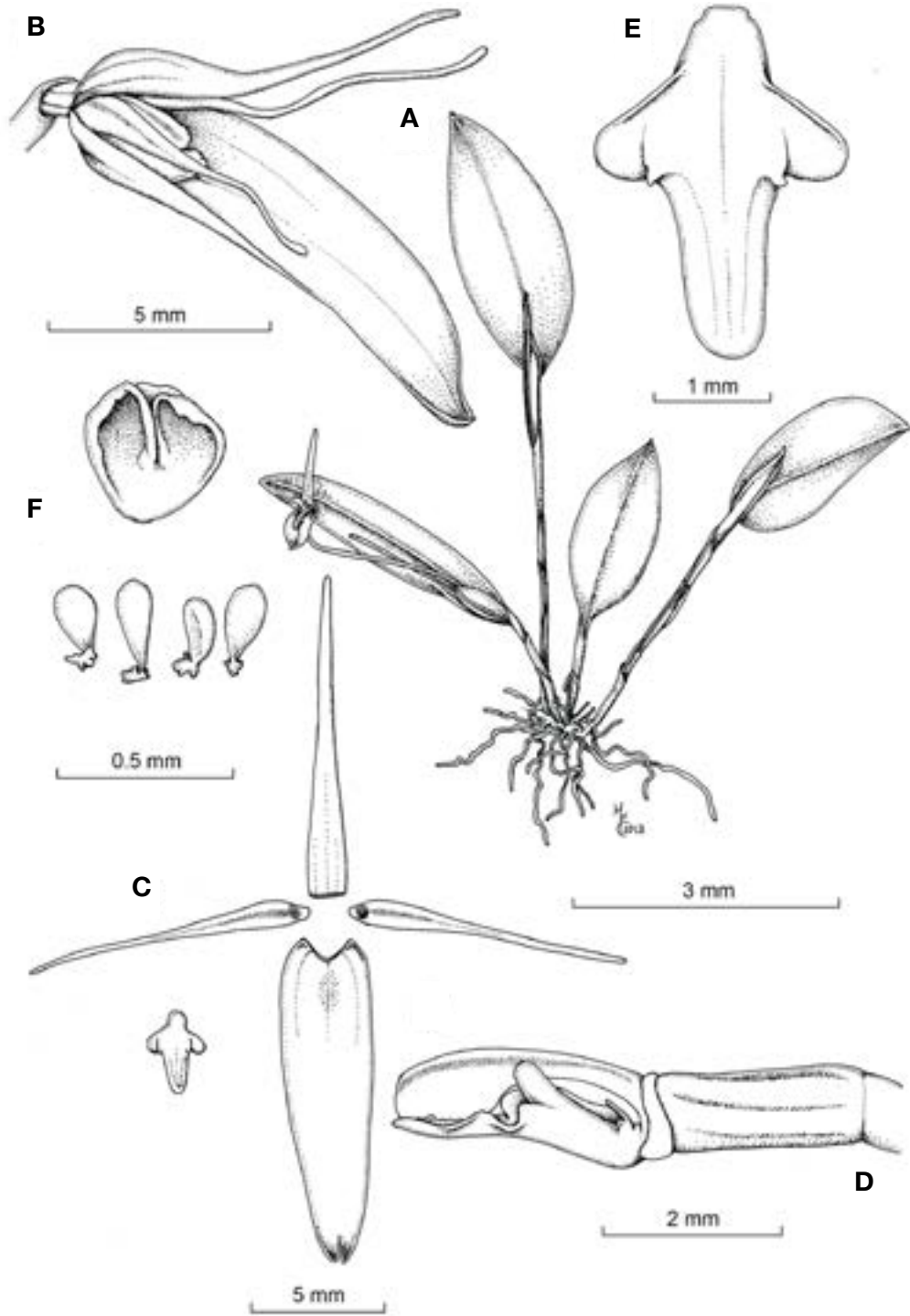


FIGURE 11. *Restrepia aberrans* Luer. A — Habit. B — Flower. C — Dissected perianth. D — Column and lip, lateral view. E — Column, front view. F — Lip, spread. G — Pollinarium and anther cap. Drawing by D. Bogarín & M. Fernández based on A.P. Karremans 5069 (JBL-Spirit).

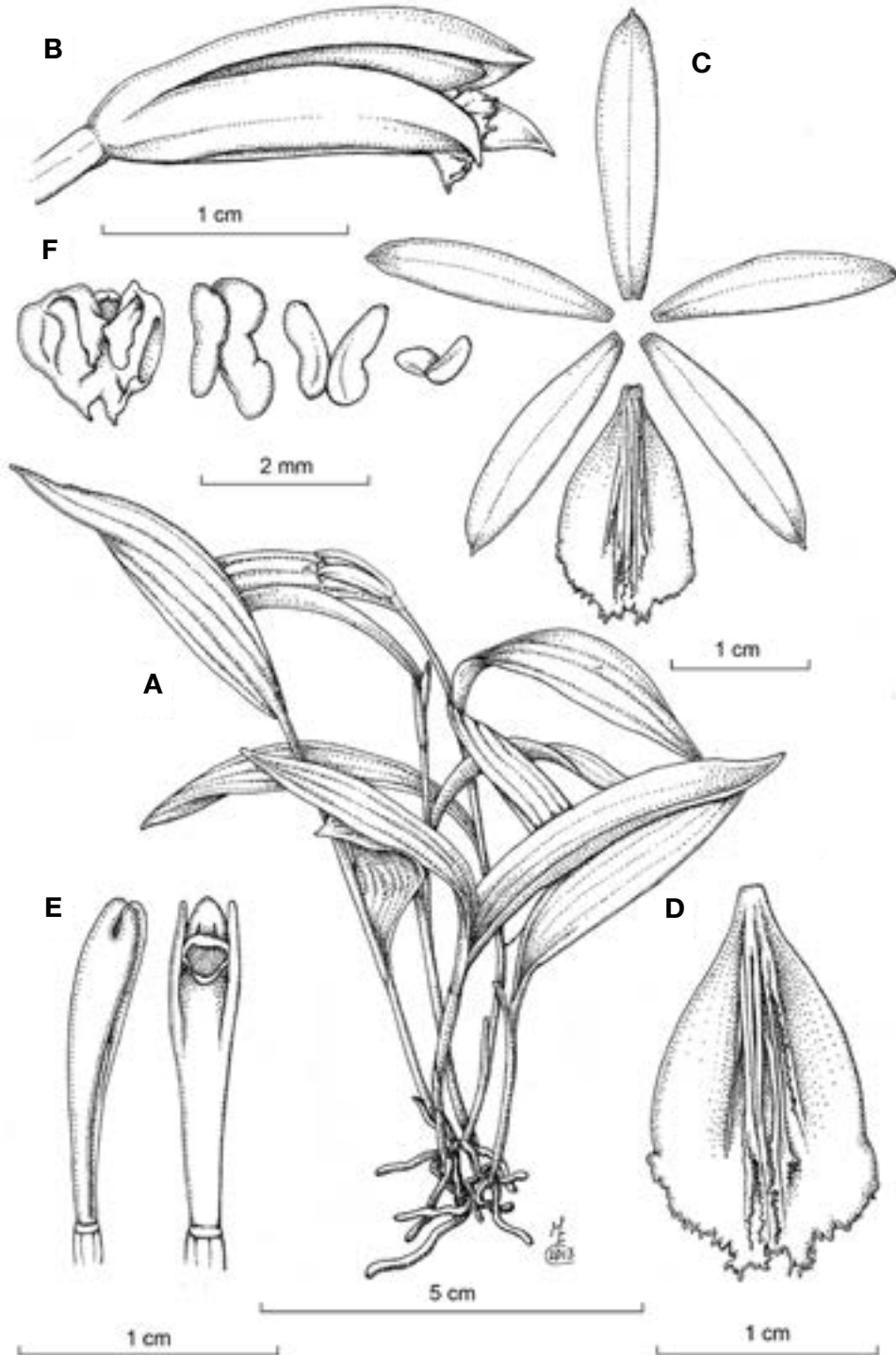


FIGURE 12. *Sobralia bletiae* Rchb.f. A — Habit. B — Flower. C — Dissected perianth. D — Column and lip, lateral view. E — Column, front view. F — Lip, spread. G — Pollinarium and anther cap. Drawing by D. Bogarín and M. Fernández based on D. Bogarín 8497 (JBL-Spirit).

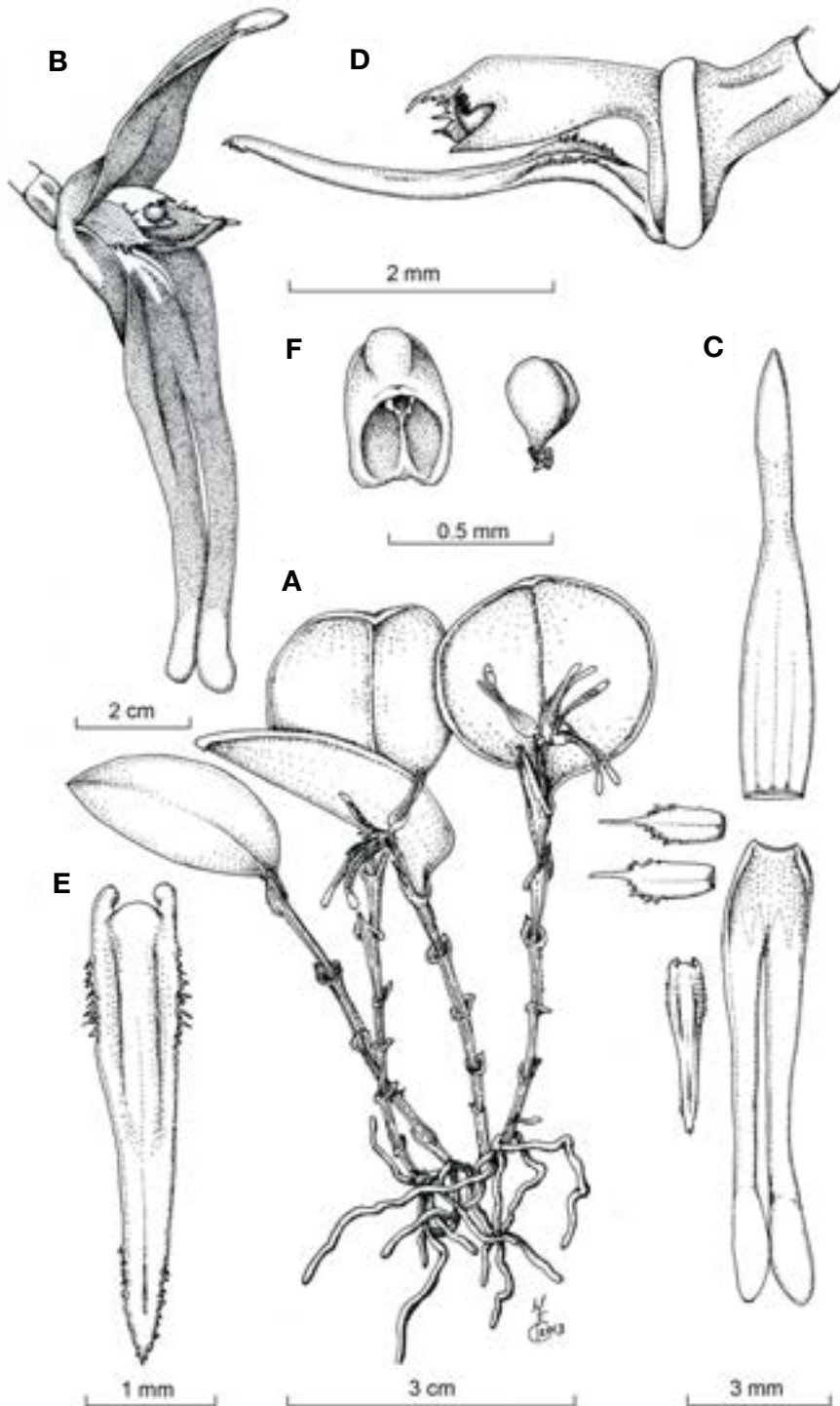
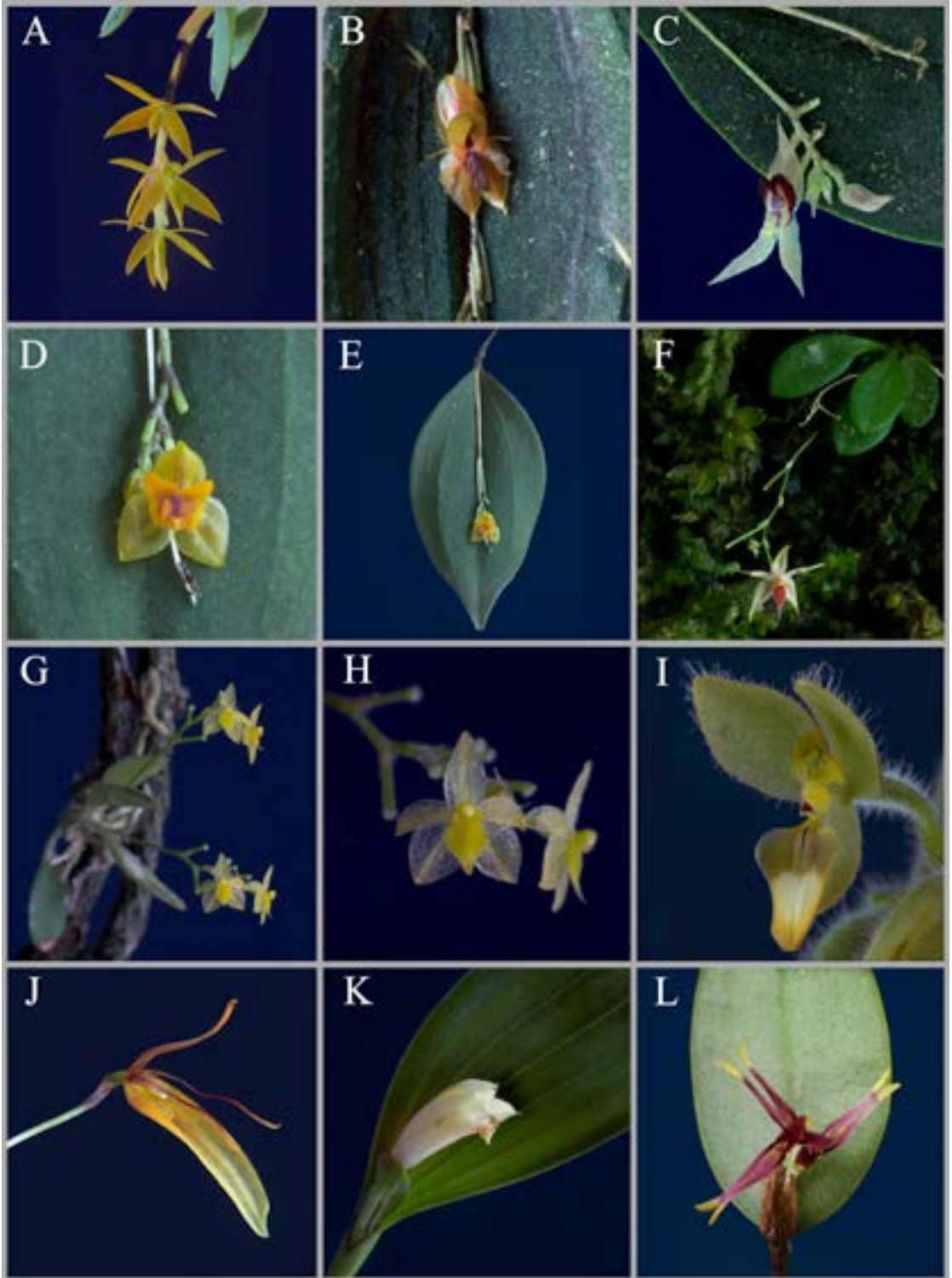


FIGURE 13. *Trichosalpinx caudata* Luer. A — Habit. B — Flower. C — Dissected perianth. D — Column and lip, lateral view. E — Column, front view. F — Lip, spread. G — Pollinarium and anther cap. Drawing by M. Fernández based on M. Fernández 546 (JBL-Spirit).



by the small, tubular flower with creamy, parallel sepals and petals, the trilobed lip with five to seven, red-to-brown keels, and a mucronate apex. The column narrows towards the base, and the pollinia are dorsally flattened.

Although several authors had reported this species as present in Costa Rica (Ames 1937, Williams 1956, Mora & García 1992, Dressler 1993, García *et al.* 1993), the existence of two Costa Rican herbarium specimens was unknown until relatively recently (Pupulin 2002, Dressler 2003): *R. L. Liesner 1817* (MO), and *E. Fletes 424* (INB, MO), both from the lowlands of the Península de Osa. This species is illustrated for the first time based on Costa Rican material.

11. *Trichosalpinx caudata* Luer & R. Escobar, Monogr. Syst. Bot. Missouri Bot. Gard. 64: 20. 1997.

TYPE: Colombia. Antioquia: La Tebaida, collected by E. Valencia, July 1988, flowered in cultivation at Colomborquideas, 16 May 1993, *C. Luer 16907* (MO).

DISTRIBUTION: Costa Rica, Panama and Colombia.

ETYMOLOGY: from the Latin *caudatus*, “caudate”, referring to the tails of the lateral sepals (Luer 1997).

HABITAT IN COSTA RICA: *T. caudata* has been found growing epiphytically at low elevations in disturbed areas close to water bodies along the northern Atlantic plains and in open areas of the Osa Peninsula, mostly at 100–250 m [to 1200–1400 m].

COSTA RICAN MATERIAL STUDIED: Alajuela: San Carlos, Boca Tapada, alrededores del Hotel Laguna de río Lagarto, en jardín del hotel Arenal Paraíso, 100 m, 10 oct 2004, *C. Ossenbach 368* & *P. Casasa* (JBL-Spirit!). Puntarenas: Osa, Cortés, fila Dominicalito, 250 m, D. Jiménez invenit, *M. Fernández 546* (JBL-Spirit!; figs. 13, 14L). Puntarenas: Osa, San Juan, cuenca media del río San Juan, siguiendo el curso aguas arriba, 200 m, flor morada de ápice anaranjado, conspicuo, 5 noviembre 1990, *G. Herrera 4568* (CR!). San José: Pérez Zeledón,

Carretera Interamericana, La Ese, km 114–122, orilla de la carretera, 9°26'N 83°35'W, 1200–1400 m, 12 julio 2005, *A. Rojas 6474* & *H. Kennedy* (JBL-Spirit!).

Trichosalpinx caudata and *T. orbicularis* (Lindl.) Luer are vegetatively almost indistinguishable. Nevertheless, the long, caudate sepals of the first are the most conspicuous differentiating character. The sepals can reach up to 8.5 mm long (vs. 3.5–6.5 mm), the dorsal sepal is narrowly triangular (vs. ovate), while the lateral sepals are connate only at the base, long-attenuate, and have a widened and fleshy apex. The petals are narrowly acute to acuminate (vs. acute to obtuse), densely fimbriate. The lip is usually twice longer than the column (vs. one-third longer than column).

ACKNOWLEDGEMENTS. We are thankful for the scientific services of Costa Rican Ministry of Environment and Energy (MINAE) and its National System of Conservation Areas (SINAC) for issuing the Scientific Passports under which wild species treated in this study were collected. To the Vice-Presidency of research of the University of Costa Rica for providing support under the projects “Inventario y taxonomía de la flora epífita de la región Mesoamericana” (814-A7-015), “Flora Costaricensis: Taxonomía y Filogenia de la subtribu Pleurothallidinae (Orchidaceae) en Costa Rica” (814-BO-052), “Filogenia molecular de las especies de Orchidaceae endémicas de Costa Rica” (814-B1-239) and “Hacia una moderna flora de orquídeas de Panamá” (814-B2-161). We are also grateful to the personnel at CR, INB, JBL and USJ for granting full access to their collections. Finally, we are grateful to Joan M. Ramírez and Darha Solano, illustrators at JBL, who prepared some of the plates included in the article.

LITERATURE CITED

- Ames, O. 1937. Orchidaceae. Orchid Family. In P. C. Standley (ed.) *Flora of Costa Rica*. Vol. 18. Field Museum of Natural History – Botany, p. 292.
- Bogarín, D. 2011. How many orchid species in Costa Rica? A review of the latest discoveries. In: A. M. Pridgeon & H. G. Navarrete Zambrano (eds.). *Proceedings of the Third Scientific Conference on Andean Orchids*, Quito. *Lankesteriana* 11(3): 185–205.

Left, FIGURE 14. A — *Epidendrum jorge-warneri*, (A.P. Karremans 5545). B — *Lepanthes ankistra* (D. Bogarín 9698). C — *Lepanthes otopetala* (D. Bogarín 8715). D & E — *Lepanthes truncata* (D. Bogarín 9652). F — *Platystele catiensis* (A.P. Karremans 5442). G & H — *Platystele tica* (A.P. Karremans 5315). I — *Ponthieva villosa* (A.P. Karremans 5040). J — *Restrepia aberrans* (A.P. Karremans 5069). K — *Sobralia bletiae* (D. Bogarín 8497). L — *Trichosalpinx caudata* (M. Fernández 546). Photographs by D. Bogarín (B, C, D, E), M. Fernández (J, K), D. Jiménez (L), A. Karremans (A, F, G, I) and F. Pupulin (H).

- Bogarín, D. & A. P. Karremans. 2010. Un nuevo *Platystele* (Orchidaceae: Pleurothallidinae) de la región central de Costa Rica/A new *Platystele* (Orchidaceae: Pleurothallidinae) from central Costa Rica. *Orquideología* 27: 208—220.
- Bogarín, D., A. P. Karremans & F. Pupulin. 2008. New records and species of Orchidaceae from Costa Rica. *Lankesteriana* 8(2): 53—74.
- Dodson, C.H. & P.M. de Dodson. 1989. *Icones Plantarum Tropicarum* 2(6): Orchids of Ecuador. Missouri Botanical Garden.
- Dressler, R. L. 1993. *Field Guide to the Orchids of Costa Rica and Panama*. Cornell University Press, p. 319.
- Dressler, R. L. 2003. *Sobralia*. Pp. 506—516 in: B. E. Hammel, M. H. Grayum, C. Herrera & N. Zamora (eds.). *Manual de plantas de Costa Rica – Volumen III, monocotiledóneas (Orchidaceae-Zingiberaceae)*. Monogr. Syst. Bot. Missouri Bot. Gard. 93.
- García Castro, J. B., D. E. Mora de Retana & M. E. Rivas Rossi. 1993. Lista de Orquídeas Comunes a Costa Rica y Panamá. *Brenesia* 39—40: 106.
- Karremans, A.P. & D. Bogarín. 2013. Costa Rica, land of endless orchids. *Orchids (West Palm Beach)* 82(7): 408—411.
- Karremans, A.P., D. Bogarín, M. Fernández, C.M. Smith & M. Blanco. 2012. New species and records of Orchidaceae from Costa Rica. II. *Lankesteriana* 12(1): 19-51.
- Luer, C.A. 1990. *Icones Pleurothallidinarum VII: Systematics of Platystele (Orchidaceae)* Monogr. Syst. Bot. Missouri Bot. Gard. 38: 1—115.
- Luer, C.A. 1991. New species of *Lepanthes* (Orchidaceae). *Lindleyana* 6(2): 64—83.
- Luer, C.A. 1996a. *Icones Pleurothallidinarum XIV. Systematics of Draconanthes, Lepanthes subgenus Marsiphanthes, and subgenus Lepanthes of Ecuador (Orchidaceae)*. Part Three: The genus *Lepanthes* subgenus *Lepanthes* in Ecuador. Monogr. Syst. Bot. Missouri Bot. Gard. 61:1—255.
- Luer, C.A. 1996b. Nuevas especies de *Restrepia* – New species of *Restrepia*. *Orquideología* 20(2): 117—120.
- Luer, C.A. 1997. *Systematics of Trichosalpinx*. Monogr. Syst. Bot. Missouri Bot. Gard. 64: 20.
- Luer, C. A. 2003. *Platystele*. Pp. 216—255 in: B. E. Hammel, M. H. Grayum, C. Herrera & N. Zamora (eds.). *Manual de plantas de Costa Rica – Volumen III, monocotiledóneas (Orchidaceae-Zingiberaceae)*. Monogr. Syst. Bot. Missouri Bot. Gard. 93.
- Luer, C.A. & R.L. Dressler. 1986. Nuevas especies de *Lepanthes* de Panamá. *Orquideología* 16(3): 3—26.
- Mora-Retana, D.E. & J.B. García. 1992. Lista actualizada de las Orquídeas de Costa Rica. *Brenesia* 37: 79—124.
- Ortiz, P. 1991. *Ponthieva* R.Br. Pp. 444—447 in: R. Escobar (ed.). *Orquídeas Nativas de Colombia – Volumen 3: Maxillaria-Ponthieva*. Compañía Litográfica Nacional S.A. Medellín.
- Pupulin, F. 2002. Catálogo revisado y anotado de las Orchidaceae de Costa Rica. *Lankesteriana* 4: 1—88.
- Sánchez, S. L. & E. Hågsater. 2007. *Epidendrum anoglossoides* Ames & C.Schweinf. In Hågsater. E. & L. Sánchez S. (eds.) *Icon. Orchid.* 9. pl. 907.
- Williams, L.O. 1956. An enumeration of the Orchidaceae of Central America, British Honduras and Panama. *Ceiba* 5(1): 25.